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CLAIMS

1 1.

What is claimed is:

2	a)	identifying a boundary curve of a source image; and
3	b)	assigning a distance value to each pixel of the distance map
4	associated with a corresponding region of the source image, wherein for	
5	each pixel, the distance value represents a distance between a center of that	
6	pixel and a nearest point of the boundary curve, wherein the nearest point	
7	is located to sub-pixel accuracy.	
1	o The	

A method of generating a distance map comprising the steps of:

- of:

 i) generating an unsigned graylevel image corresponding to the
- source image; and

 ii) applying a threshold value to the unsigned graylevel image to form a signed graylevel image, wherein a sign change between graylevel values of adjacent pixels indicates a boundary curve intersection, wherein the sign change identifies the adjacent pixels as boundary pixels.
- 1 3. The method of claim 2 wherein step b) further comprises the step of:
- i) calculating a distance from a center of each boundary pixel to
 a nearest interpolated boundary curve intersection as the distance value
- a nearest interpolated boundary curve intersection as the distance val.

 4 for boundary pixels; and
- ii) propagating distance values from each pixel to adjacent pixels
 to generate an unsigned interim distance map.

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- 1 4. The method of claim 3 wherein for each selected pixel, m_i = the
- 2 minimum of the distance values of the neighboring pixels above and
- 3 below the selected pixel, wherein m_j = the minimum of the distance
- 4 values of the neighboring pixels to the left and right of the selected pixel,
- 5 wherein h corresponds to a pixel size, wherein Tij = a current distance
- 6 value for the selected pixel, wherein a proposed update value, u, is
- 6 Value for the selected pixer, wherein a proposed update value, in
- 7 assigned a value as follows:

$$u = \frac{m_i + m_j + \sqrt{2h^2 - (m_i - m_j)^2}}{2}, \text{ if } \left| m_i - m_j \right| < h \text{ otherwise } u = \min(m_i, m_j) + h,$$

- 9 wherein Tij is updated to min(Tij,u).
- 1 5. The method of claim 3 wherein step b) includes the step of
- 2 performing each of the following passes to propagate the distance
- 3 information throughout the image: top-to-bottom and left-to-right, top-to-
- 4 bottom and right-to-left, bottom-to-top and left-to-right, bottom-to-top and
- 5 right-to-left.
- 1 6. The method of claim 3 wherein step b)(ii) further comprises the step
- 2 of assigning a sign of each pixel of the signed graylevel image to the
- 3 distance value in the corresponding location of the unsigned interim
- 4 distance map to generate a signed first distance map.
- 1 7. The method of claim 6 further comprising the step of:
- 2 c) downsampling the first distance map to generate a second
- 3 distance map having a second resolution.

- 1 8. The method of claim 7 further comprising the step of:
- 2 d) applying a soft threshold filter to the second distance map to
- 3 reconstruct the source image, wherein the reconstructed source image has
- 4 the second resolution.
- 1 9. The method of claim 7 further comprising the step of:
- 2 d) applying an interpolation filter to the second distance map to
- 3 generate an interpolated distance map having the first resolution.
 - 10. The method of claim 9 further comprising the step of:
- e) applying a soft threshold filter to the interpolated distance
- 3 map to generate a reconstructed source image having the first resolution.
- 1 11. The method of claim 1 wherein the source image comprises
- 2 boundary curves defined by continuous parametric functions.
- 1 12. A method comprising the steps of:
- a) computing a first distance map of a source image; and
- 3 b) downsampling the first distance map having a first
- 4 resolution to form a second distance map having a second resolution.
- 1 13. The method of claim 12 further comprising the step of:
- 2 c) applying a soft threshold filter to the second distance map to
- 3 form a reconstructed source image having the second resolution.

- 1 14. The method of claim 12 further comprising the steps of:
- 2 c) interpolating the second distance map to generate an
- 3 interpolated distance map having the first resolution; and
- 4 d) applying a soft threshold filter to the interpolated distance
- 5 map to generate a reconstructed source image having the first resolution.
- 1 15. The method of claim 12 wherein the first resolution is greater than
- 2 the second resolution.
- 1 16. The method of claim 12 wherein step a) further comprises the steps
- 2 of:
- i) identifying at least one boundary curve of the source image;
- 4 and
- 5 ii) assigning a distance value to each pixel of the first distance
- 6 map, wherein each pixel is associated with a region of the source image,
- 7 wherein for each pixel, the distance value represents a distance between a
- 8 center of that pixel and a nearest point of a nearest boundary curve,
- 9 wherein the nearest point is located to sub-pixel accuracy.
- 1 17. The method of claim 16 wherein step (a)(i) further comprises the
- 2 step of applying a threshold value to a graylevel rendering of the source
- 3 image to form a signed graylevel image, wherein a sign change between
- 4 graylevel values of adjacent pixels indicates a boundary curve lies between
- 5 centers of the adjacent pixels, wherein the sign change identifies the
- 6 adjacent pixels as boundary pixels.

- 1 18. The method of claim 16 wherein step (b)(ii) further comprises the
- 2 steps of:
- 3 1) calculating a distance from a center of each boundary pixel to
- 4 a nearest interpolated boundary curve intersection as the distance value
- 5 for boundary pixels; and
- 6 2) propagating distance values from each pixel to adjacent pixels 7 to generate an unsigned distance map.
- 1 19. The method of claim 18 wherein step b)(ii) further comprises the
- 2 step of assigning a sign of each pixel of the signed graylevel image to the
- 3 distance value in the corresponding location of the unsigned distance map
- 4 to form the first distance map.
- 1 20. The method of claim 14 wherein the threshold filter is a soft
 - threshold filter such that distance values less than a first pre-determined
- 3 threshold (z1) are mapped to a first value, wherein distance values greater
- 4 than a second pre-determined threshold (z2) are mapped to a second
- 5 value, wherein z1<z2, wherein distance values between z1 and z2 are
- 6 mapped to unsigned graylevel values [0,N].